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a suggestion prove acceptable there would be the three adjective series: homozygous, heterozygous, and hemizygous, referring to the three possible conditions with respect to any single gene, namely, "like mates," "differing mates," and "no mate."

The term might also be used in cases where a non-deficient chromosome is paired with a deficient one. The deficient individual would be hemizygous for the genes at those loci of the non-deficient chromosome which were involved in the deficiency of its mate.

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CROSS-OVER VALUES IN THE FRUIT-FLY, *DROSOPHILA AMPELOPHILA*, WHEN THE LINKED FACTORS ENTER IN DIFFERENT WAYS

THE factors for bar, round, red and white eye are sex-linked, being located in the X-chromosome, as shown in inheritance. For example, when a bar-eyed male is mated to a normal female all the resulting male offspring (F1) are normal and all of the females bar eyed, as bar is dominant; that is, factors that occur in the X or first chromosome have a "criss cross" mode of inheritance following the distribution of the X-chromosomes, there being but one X-chromosome in the males and two in the females.

The relative positions of the linear series of factors in the X-chromosome of *Drosophila* have been determined by Morgan and Bridges (237 Carnegie Institution). Factors that lie near together in the chromosome are more likely to be transmitted in the same combinations to the gametes than those that lie far apart; that is, the strength of linkage depends on the distance apart of the factors. The failure to transmit the same combinations of factors that enter from the parents to all the offspring is due to a crossing-over of some of the factors. For example, a red bar-eyed fly, mated to a white round-eyed fly, give in the second generation (F2) white bar and red round-eyed flies, as well as flies like the original parents; that is, there has occurred a recombination of the factors due to crossing-over.

Are the cross-over values the same when the linked factors enter in different ways? My experiments performed in the University of Chicago Laboratories give data relative to this question. Using the presence and absence hypothesis, let (B) represent the factor for bar and (R) the factor for red, then let

(b) represent the absence of the factor for bar and (r) the absence of the factor for producing red-eyed flies. The factorial composition, then, of the red bar-eyed flies is (BR) and for white round-eyed flies (br). As both the factors for bar- and red-eyed flies are sex linked—that is, they occur in the X-chromosome, there being but one in the male and two in the female, as above mentioned. Then the male red bar-eyed flies are represented by (BR) and the female white round-eyed flies by (br—br).

Matings were made as follows:

(2 pairs) Red bar-eyed males (BR). White eyed females (br—br) F1
171 White round-eyed males (br). 184 Red bar females (BR—br).

	F2 Males.				F2 Females.			
	Red Bar.	White Bar.	Red.	White.	Red Bar.	White Bar.	Red.	White.
(27.1)	50	37	32	50	49	31	42	34
“.2	26	17	30	31	38	25	27	40
“.3	39	32	29	42	40	21	33	30
“.4	26	15	27	17	28	12	29	17
“.5	53	26	55	41	51	27	35	29
“.6	32	11	23	26	43	17	27	30
	226 (BR)	138 (Br)	196 (Rb)	207 (br)	249 (BR br)	133 (Br br)	193 (Rb br)	180 (br br)

As white bar-eyed flies and red-eyed flies are the cross-over classes, then the percentage of crossing-over is equal to 660, divided by 1,522, and the quotient, multiplied by 100, giving 43.3 per cent.

I next extracted pure lines of white bar-eyed flies and red-eyed flies, using the white bar-eyed males and red round-eyed females in the matings. Their factorial composition being (Br) for the males and (Rb—Rb) for the females.

F1 99 red-eyed males (Rb) and 105 red bar-eyed females (Rb—Br) F2
(from about thirty matings from F1).

Males.				Females.	
Red Bar.	White Bar.	Red.	White.	Red Bar.	Red.
1127 (BR)	1265 (Br)	1456 (Rb)	1045 (br)	2658 (BR or else Rb) (Br Rb)	2606 (Rb or else Rb) (br Rb)

The cross-over classes are the red-bar and white-eyed male flies. The percentage of crossing-over being 2,172, divided by 4,893, and the quotient, multiplied by 100, which gives 44.4 per cent. The difference, then, in the cross-over values when the linked factors entered in different ways was but 1.1 per cent., which does not seem to be a significant difference.

J. D. IVES.

ON COUNTING CHROMOSOMES IN POLLEN-MOTHER CELLS

THE genetic study of hybrids between species with different chromosome numbers and of certain mutants requires the counting of many chromosome groups and raises the question of the best technique for the purpose. The staining qualities of aceto-carmin, which has long been used for preliminary work, especially by zoologists, are considerably improved by a trace of ferric salt. (Bolles Lee, in his well-known manual, gives formulæ for iron carmin; but this has no advantage for sections over iron hæmatoxylin.)

Iron Aceto-carmin 1.—Ordinary aceto-carmin is prepared by heating a 45 per cent. solution of glacial acetic acid to boiling with excess of powdered carmin, cooling and filtering. The young anthers are teased out with steel blades or needles in a drop of this until it changes slightly toward bluish red. An excess of iron spoils the preparation. Anther remains are removed, and a large thin coverglass (22 by 50 mm.) applied, using the minimum of liquid. The edges are sealed with vaseline. The preparation, if there is no excess of iron, may improve for a day or two.

Iron Aceto-carmin 2.—To a quantity of aceto-carmin a trace of a solution of ferric hydrate dissolved in 45 per cent. acetic acid is added until the liquid becomes bluish red, but no visible precipitate forms. An equal amount of ordinary aceto-carmin is then added. The anthers are teased out with nickel instruments. If the stain is too dark, more aceto-carmin is to be supplied. It may be diluted with 45 per cent. acetic.

Iron Aceto-carmin 3.—Anthers at the right stage are put into a mixture of 1 part of glacial acetic acid to 9 parts of absolute alcohol, to which sufficient solution of ferric hydrate in 45 per cent. acetic has been added to color the liquid brown (the amount